APPARATUS AND METHOD FOR OPERATING CURRENT DEPENDENT ELECTRONIC DEVICES

The present invention relates to an apparatus and method for operating one or more electronic devices which require a constant given current. In particular, the invention concerns operating a number of current devices such as light emitting diodes (LEDs) mounted on conductive strip to provide an elongate lighting strip.

Such lighting strips are well-known for example to mark the way to emergency exits on aircraft. They comprise a plurality of LEDs mounted at intervals along a conductive strip encased in plastic. LEDs, in common with a number of other electrical devices, are current devices, that is they rely on a constant current to operate, rather than a constant voltage.
The life and brightness of a LED can be maximised by accurately controlling the current.

Known lighting strips have a driver apparatus which is designed to operate a given number and a particular type of LED. If the driver is used on a strip having a different number of LEDs or a different type of LED, then the drive apparatus must be completely reset which is a time-consuming, awkward and inefficient process.

The present invention provides an apparatus for operating one or more electronic devices requiring a given current, comprising a regulator device providing a voltage output, and a feedback loop having a reference device connected to the voltage

output and requiring the same current as the electronic devices, a measuring and conversion device operable to measure the current through the reference device and convert it to a voltage value and return it to the regulator device, wherein the regulator device is operable to adjust the output voltage in response to the voltage value until the measured current is equal to the given current required.

In the present invention, use of a reference device of the same type as the electronic device that is to be operated allows the regulator automatically to adjusted to produce an absolute voltage of the appropriate level to drive the remaining devices. In this way, the apparatus is able to produce the correct voltage, automatically compensating for both short and long term drift, for any type and number of electronic devices being used.

Preferably, the measurement and conversion device consists of a resistor and a current monitor.

The electronic devices are typically light emitting diodes, mounted on a conductive strip having a plurality of conductive elements.

The electronic devices may be parallel connected devices which are polarity sensitive, and the regulator may be connected to a three phase bridge to operate the conductive elements in the strip, and a micro controller operable to control the sequence in which the LEDs on the strip are operated.

Preferably, the regulator comprises a steady state DC device.

In a further aspect, the invention also provides apparatus for emitting electromagnetic radiation (EMR) comprising a plurality of electronic devices operable to produce EMR when provided with a given current mounted on a conductive strip which is connected to an apparatus of the type described above.

The present invention also provides a method for operating one or more electronic devices requiring a given current, comprising the steps of providing a voltage output, supplying the voltage output to a reference device requiring the same current as the electronic devices, measuring the current in the reference device, converting the measured current to a voltage value and adjusting the voltage output in response to the voltage value until the measured current in the reference device is equal to the given current required by the electronic devices.

Preferably, the method involves initially providing a voltage output sufficient to produce a current lower than the given current and gradually increasing the voltage output until the given current is obtained in the reference device.

The present invention will now be described in more detail, by way of example only, with reference to Figure 1, which is a circuit diagram of one embodiment of apparatus in accordance with the present invention.

The principal feature of the present invention is that an electronic device of the same type as those to be operated is incorporated into a feedback loop of the apparatus. As shown in Figure 1 a regulator device 10 is connected to the electronic devices to be driven. The regulator 10 is preferably, but not exclusively, a steady state DC device for accuracy. In this example, the electronic devices are LEDs (not shown) mounted on a conductive strip having three conductors 12. A three-phase bridge 14 is connected between the regulator device 10 and the conductors 12. The regulator 10 may also be connected to a micro controller 16, itself connected to the three-phase bridge 14, for example to control the sequence of operation of the LEDs in the conductive strip.

The regulator 10 is also provided with a feedback loop. The voltage output from the regulator 10 also passes through a current measuring device such as a resistor 18 and a reference LED 20 of the same type as those in the strip which are to be driven. The resistor 18 is also connected to a current monitor device 22. Together the resistor 18 and the current monitor 22 act to measure the current passing through the reference LED 20 and to convert it to a voltage. This is passed back to the regulator 10. Since the desired current for the LEDs in the conductive strip is known from the outset and the reference LED 20 is of the same type as the LEDs to be operated, this feedback loop allows the voltage output from the regulator 10 to be adjusted to the appropriate level so that the desired current is achieved.

In operation, the regulator 10 will initially be set to produce a voltage output which is lower than that required to provide the desired current. The current through the reference LED 20 is then measured as the voltage output is gradually increased until the desired current through the reference LED 20 is achieved. At this point, the voltage output from the regulator 10 will be at the right level to operate the LEDs in the lighting strip in an optimum manner.

Another important feature of the lighting strip of the preferred embodiment of the present invention is that it is directly driven by a controlled voltage source thus removing the requirement for resistors within the lighting strip itself. Removal of the resistors from the lighting strip reduces the capacity for the lighting strip to heat up and consequently reduces the power consumption of the lighting strip.

Certain applications may also require minimisation of Electro Magnetic Compatability (EMC) interference for use in particularly sensitive environments. The present invention can significantly reduce such interference by providing a standing DC voltage just below the threshold level required to operate the LEDs and superimposing small pulses which raise the voltage above the threshold in order to switch the LEDs on. The switching voltage is thus a fraction of the full operating voltage then and the electro magnetic interference can be significantly reduced. For optimum performance the voltage pulses can have soft edges.

It will be appreciated that a number of modifications and variations to the details described above can be made. For example, if the lighting strip includes LEDs of different colours, the regulator 10 may be provided with separate feedback loops with a reference LED of each colour and the micro controller may be used to control which LEDs are to operate at a given time. In addition, it will be appreciated that the present invention is not restricted to use with conductive strips having LEDs, or indeed to conductive strips having devices which emit visible light. The invention is equally applicable to use with devices producing other wavelengths in the electromagnetic spectrum, whether producing visible light or not.

The invention provides a simple and efficient manner in which to operate current devices, which is easily adaptable to operating different types and numbers of devices.